# 2

# DIGITAL ENVIRONMENT

## Background

In order to fully appreciate why and how to transition to a Digital Environment (DE), it is necessary to have a basic understanding of the environment, ongoing initiatives, and those agencies that play the most active roles. This chapter will discuss the background behind the Department of Defense (DoD) efforts to establish a DE, provide working level definitions of the common terminology, and explain how and where current initiatives are focused.

## History

The current DoD effort to move acquisition and logistics into the digital age began in late 1984 with the enactment of Public Law 98-525 *Plans for Management of Technical Data and Computer Capability Improvements*. An outgrowth of this Law was an Institute for Defense Analysis (IDA) study released in June of 1985 that recommended a strategy and master plan for Computer Aided Logistics Support (CALS) for management of technical data. A policy memorandum entitled *Computer-Aided Logistics Support* signed by the Secretary of Defense in September 1985 established a DoD CALS office with the goal of implementing the recommendations of the IDA study. The goal of CALS was the digital acquisition of logistics information products to include technical manuals and training materials, technical data packages, and product definition data.

Starting in the late 1980s the role of CALS grew. The definition of CALS changed in 1987 to Computer-aided Acquisition and Logistics Support. This change in scope attempted to move CALS from a logistics focused program to a weapon system life cycle focused program. Also during the late 1980s, other digital information initiatives, such as Electronic Commerce/Electronic Data Interchange (EC/EDI) emerged to enable computer-to-computer exchange of business information. The cost of computer-based transactions was dramatically reduced, increasing efficiency and reducing errors largely by eliminating rekeying of data. EC/EDI also provided a standardized means to integrate business functions, enable process improvements, and establish a basis for virtual enterprises.[1]

This transition in scope continued in 1993 when CALS was again renamed, this time to Continuous Acquisition and Life-cycle Support. This title explicitly expanded the role of CALS to a total life cycle focus.[2] During this period EC/EDI were part of the CALS Office that re-

ported to the Deputy Under Secretary of Defense (Logistics) (DUSD(L)). In 1994, Public Law 103-355, *Federal Acquisition Streamlining Act (FASA)*, directed that the Federal Government possess the capability to support EDI-based procurements up to $100,000. That year, EC/EDI responsibilities were moved from the CALS Office to an Electronic Commerce (EC) Office, established under the Deputy Under Secretary of Defense (Acquisition Reform) (DUSD(AR)). While supporting DoD-wide efforts to enable the exchange of a variety of business processes through EDI, the primary responsibility of the EC Office is to manage the implementation of EDI-based contracting.[3]

Recognizing the fact the CALS effort started in the logistics community and organizationally remains under logistics makes it exceptionally hard to overcome the stereotype that CALS is a purely logistics program. Interviews with several senior DoD officials highlighted CALS current efforts primarily concentrate on logistics and sustainment activities. Similarly, EC Office efforts have been largely directed at the contracting community and small procurements, despite significant support to other EDI-related business processes. While both the CALS and EC/EDI offices are working to advance the Acquisition Community, the perception in the field is that they are separate, functionally based initiatives that do not specifically focus on, or address the information and business needs of the Program Manager (PM).

In addition to the CALS and EC/EDI offices, the Office of the Director, Defense Procurement and the Defense Information Systems Agency (DISA) also have active roles. Thus, spreading the responsibility for the digital environment across several organizations. Research interviews found this to be a concern within Program Management Offices (PMOs) and industry, as decision makers attempt to identify who is in charge.

**Major Players**

While DoD would like to present a *single face* to industry, the Services, and PMOs, there are a variety of organizations involved in different aspects of the digital environment. A digital environment that supports the acquisition community must interconnect with the defense information infrastructure (DII) which, in turn, is an integral part of the national information infrastructure (NII). Agencies, apart from DoD, such as NASA, Department of Commerce, Department of Treasury, and Department of Energy are also affected. Business processes and standards clearly have applications beyond the Federal Government. With global business partnerships becoming more commonplace, there are international as well as national implications, and industry plays a critical role. This section describes some of the major players involved in aspects of the digital environment, particularly as they impact the acquisition community. While many of these organizations will not directly affect PMOs, it is useful to understand their areas of focus and the roles they play (see Figure 2-1).

**DoD CALS Office**

The DoD CALS Office, under the DUSD(L), is responsible for leading the DoD CALS effort. The CALS Office responsibilities include:

- Coordinate with appropriate Principal Staff Assistants (PSAs) to define the Integrated Data Environment (IDE) for business and technical information used in support of system acquisition and life cycle support. The IDE will be congruous with industry practices and the overarching DoD information infrastructure being developed by DISA.

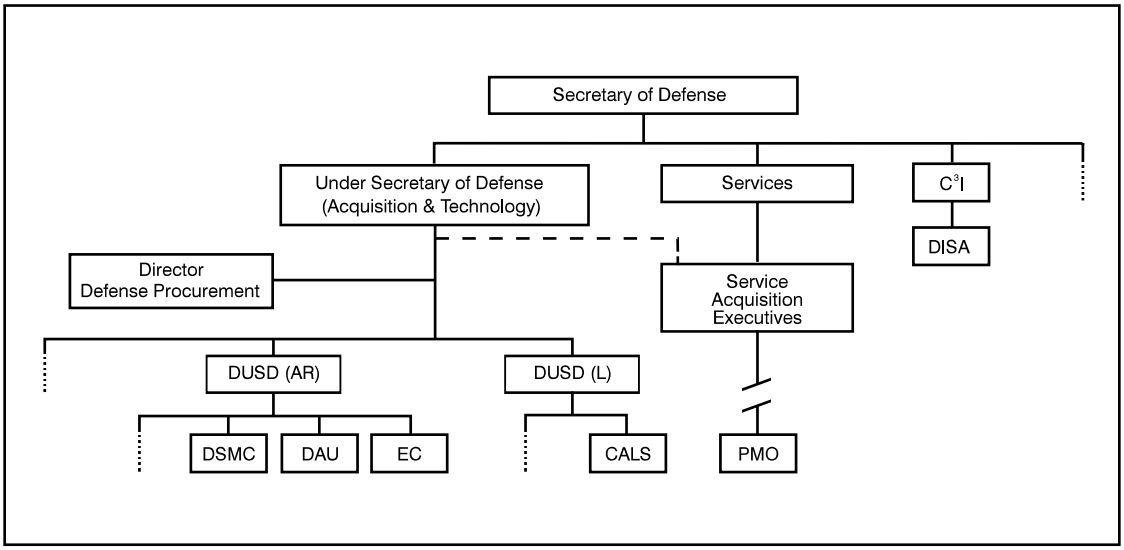


Figure 2-1. Major DoD Organizations Involved in the Digital Environment

- Coordinate the IDE framework within the DoD and to ensure integration of those requirements into DoD programs and processes.

- Participate with other government departments in an industry outreach program. Through that program, the CALS Office promotes a common shared information framework, compatible information infrastructures, and similarity of acquisition practices.[4]

In support of acquisition community efforts to further the IDE vision, the CALS Office has produced *The Program Manager's Desktop Guide for Continuous Acquisition and Life-Cycle Support (CALS) Implementation*, dated 29 September 1995.[5] This CD-ROM based package is a useful tool in developing an approach to the digital environment, particularly for new programs.

**DoD Electronic Commerce (EC) Office**

The DoD EC Office was established under the DUSD(AR) in 1994. The EC Office is responsible for facilitating the implementation of EC/EDI across all functional lines within DoD, and developed the *Introduction to Department of Defense Electronic Commerce: A Handbook for Business*, Version 2, dated June 1996. This is a useful source of EC/EDI information.

To date, the primary focus of the DoD EC Office has been to manage the implementation of EDI-based contracting systems within 244 DoD installations. These sites initiate 98 percent of DoD's small purchases. (Note: This is 98 percent of the number of transactions, not 98 percent of the dollar total.) When completed, this will enhance access by small businesses to small purchase Request for Quotes (RFQs) and assure that the Federal Government possesses the capability to support EDI-based procurements up to $100,000 in accordance with FASA. For the future, the EC office is actively pursuing the development of EDI applications that will enable additional business transactions beyond small purchases. Release of schedule and implementation guidance is expected in early FY 97.[6]

**Director, Defense Procurement**

As a Principle Deputy to the Under Secretary of Defense for Acquisition and Technology (USD(A&T)), the Office of the Director, Defense Procurement develops, interprets, and publishes procurement policy for DoD. This includes establishing requirements and guidelines that regulate the exploitation of digital environments, and playing an integral role in DoD Business Process Improvement initiatives. Defense Procurement sets policy for government rights to technical data, and develops standardized procurement data definitions and a standard procurement process.[7]

**Defense Information Systems Agency (DISA)**

Under the auspices of the Assistant Secretary of Defense (Command, Control, Communication, and Intelligence) (ASD(C3I)), DISA is responsible for promulgation of standards and primary support of the DII. With respect to the development of a digital environment, DISA's role can be categorized as follows:

> *The computer systems architecture will be developed in close coordination with Defense Information Systems Agency (DISA) and will be fully integrated with system migration planning to be ultimately realized via the DII. The objective of the architecture is to fully describe the communications and computer system infrastructure necessary to support the IDE and to develop the plan to efficiently migrate both the CALS Flagship systems and the remainder of the DoD computer systems infrastructure that supports the weapon system life-cycle to an IDE state. The computer systems architecture will include a systems specification that identifies the interfaces and performance standards necessary to meet the functional requirements of the weapon system support community.*[8]

The CALS Digital Standards Office at DISA is charged with overseeing CALS standards activities.[9] DISA is also responsible for providing information pertaining to the testing and certification of Value Added Networks (VAN), which support the DoD EDI effort.[10]

**Defense Acquisition University / Defense Systems Management College (DAU/ DSMC)**

The DAU is a consortium of DoD education and training institutions and organizations that provide mandatory and assignment specific acquisition courses for military and civilian personnel serving in acquisition career fields. Its mission is to educate and train professionals for effective service in the Defense acquisition process.[11] The premier consortium member responsible for training the acquisition community, notably PMs, is DSMC. With respect to the exploitation of a digital environment, education and training programs/courses within the acquisition community that touch upon this area are focused almost exclusively on specific functional applications (i.e. logistics, contracting, configuration management) and/or taught as functional electives. Programs that address "integrated" digital environments and cross functional use of information are being examined on a limited basis but are not currently in place.

**National Institute of Standards and Technology (NIST)**

An agency of the U.S. Department of Commerce's Technology Administration, NIST's primary mission is to promote U.S. economic growth by working with industry to

develop and apply technology, measurements, and standards. Although external to DoD, NIST plays an active role in the development of current and future standards and technologies that will be used throughout the acquisition process. In addition to addressing CALS functions and standards within their Enterprise Integration office, NIST plays a particularly active role in the development of business transaction standards that support EDI.

**Industry Steering Group**

The CALS Industry Steering Group (ISG) is a coalition of industry representatives working with CALS and the NIST Enterprise Integration Office. The ISG works closely with Trade Associations and both U.S. and foreign governments to promote CALS principles and formulate policies and outreach. Many within industry have begun re-defining the term CALS to mean Commerce at Light Speed, embracing more aspects of business processes, particularly EDI. A depiction is shown in Figure 2-2.

A significant effort, sponsored by the ISG, is the CALS EXPO, an annual international conference addressing CALS, EC/EDI, and Enterprise Integration issues. The ISG is structured by task groups, which are functional steering groups working on particular issues.

The National Technical Information Service (NTIS) provides distribution for ISG CALS information and makes available CALS EXPO Proceedings and reference books, attendee lists, meeting minutes, meeting announcements, tutorials, videotapes, and other information relating to CALS. In cooperation with the ISG, through the National Security Industrial Association (NSIA), NTIS also makes available the

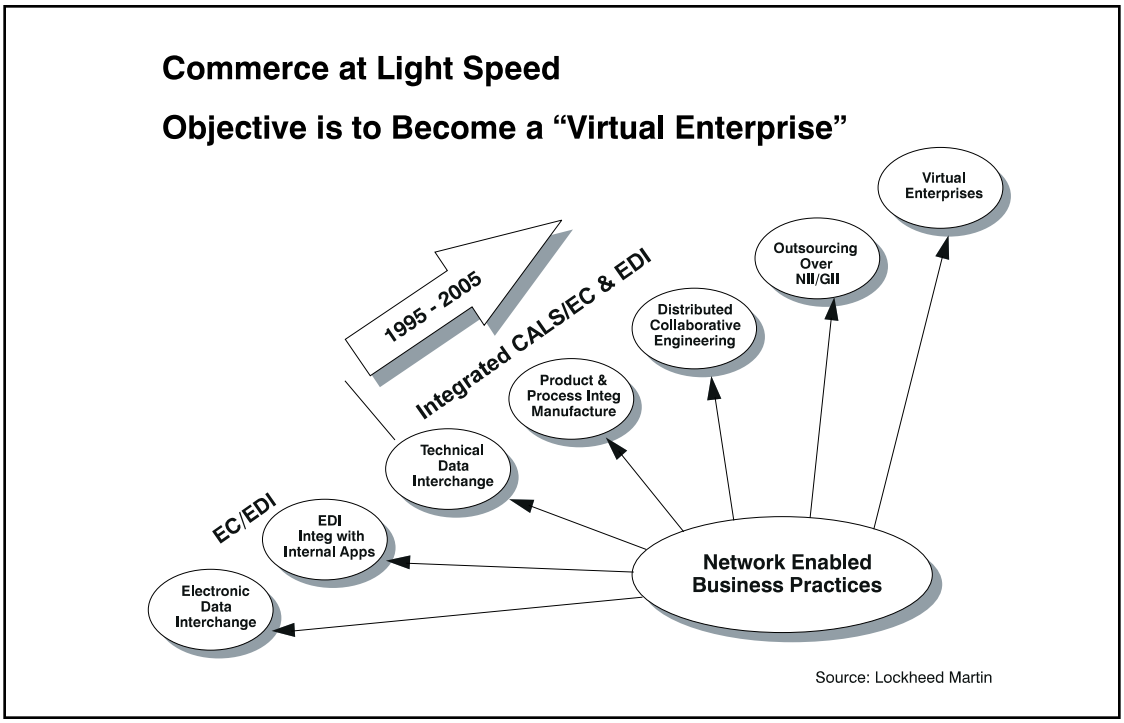


Figure 2-2. CALS: Commerce at Light Speed

*Introduction to CALS Kit*—a multimedia training package last released in September 1994.[12]

**Electronic Commerce Resource Center (ECRC)**

A significant source of information concerning EC/EDI and CALS initiatives nationwide are the ECRCs. There are currently 11 ECRC locations (see Figure 2-3) throughout the United States. The main focus of the ECRC is to provide education and outreach services to small businesses. However, they also provide generic training for a small fee to anyone interested in EC/EDI and CALS. Services provided by the ECRC's include:

- Providing regional information, training and consulting services, especially for small-to-medium-sized enterprises;
- Providing expert services and information to other providers in that nation-wide manufacturing extension network; and
- Developing critical information technologies to fill current gaps in information technology areas.

"In short, the mission of the ECRC program is to promote awareness and implementation of EC and related technologies into the U.S. integrated civil-military industrial base. The ECRC program consists of the National ECRC Technology Hub, ECRC Team Integrators, and Regional ECRCs."[13]

**Definitions and Terms**

In an effort covering the entire life cycle of weapon systems that has had three different titles in ten years, it is understandable that the terms and acronyms have not only changed but have come to mean different things to different stakeholders. This section will provide an overview of some of the major terms and initiatives that impact PMOs entering the digital environment. Appendix A provides an extended list of acronyms and terms that provide additional information.

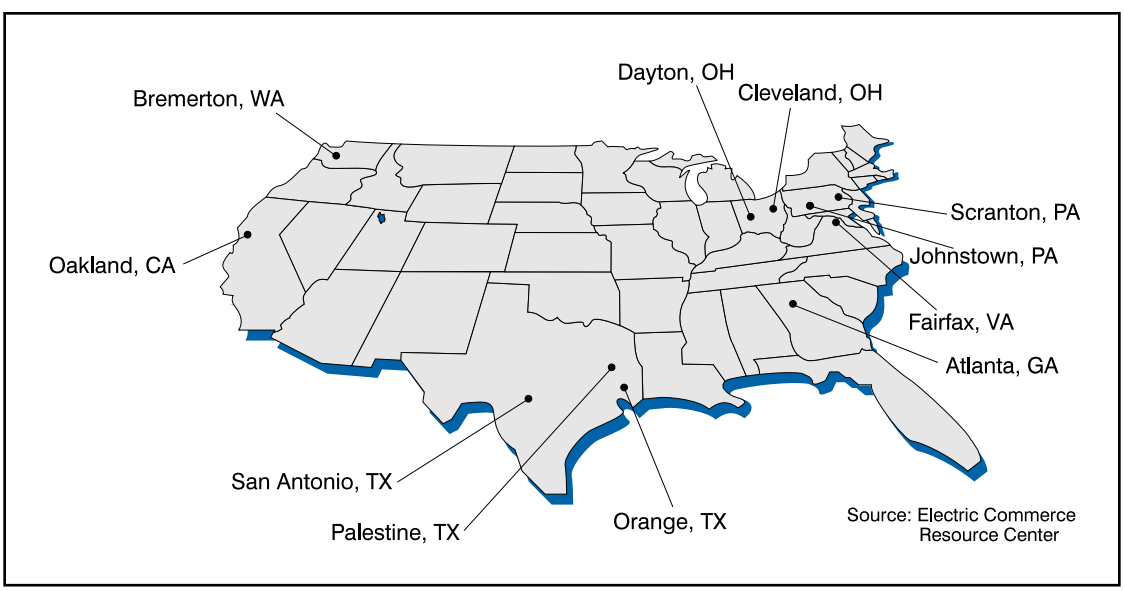


Figure 2-3. ECRC Locations

**Continuous Acquisition and Life-Cycle Support (CALS)**

CALS is a DoD and industry strategy to accelerate the pace at which high quality information flows within and between DoD and its business partners; while at the same time providing an opportunity to reduce information management overhead costs. CALS is defined as a core strategy to share integrated digital product data through a set of standards to achieve business efficiencies in business and operational mission areas. For more information on CALS Standards, see Appendix B.

According to the DoD CALS Office, DoD is committed to incorporating CALS into functional process improvements. As DoD applies the best technologies, processes, and standards for the development, management, exchange, and use of business and technical information among and within governmental and industrial enterprises, an IDE will be generated. DoD has developed this strategic plan to pursue it's IDE vision. It sets the following three goals for pursuing that vision:

- Expand its relationship with industry to ensure more harmonious methods of operation and seamless data exchange;
- Complete the transition of its active information and business transactions to electronic formats; and
- Integrate digital information across product life cycles.[14]

**Integrated Data Environment (IDE)**

The IDE is the business environment created by the application of existing national and international standards, practices, and technologies to automate the management and exchange of information (See Appendix B). The vision of this DoD-wide IDE is a boundaryless environment where all data are accessible to appropriately cleared personnel across all defense enterprises. The IDE enables integrated product and process development (IPPD) while increasing the agility and decreasing cycle times of the defense enterprise.

"The IDE represents the end state of the CALS vision in which technical and business data is [are] highly visible and accessible to all participants in life-cycle process execution. Current high quality business and product data is [are] generally available at its source of generation in digital form. Widespread use of such source data on an as needed basis transforms data from an overhead cost item to an enterprise asset. A communications and information management infrastructure provides the conduit in which the information flows from source to authorized user. In addition, functional information management services and other implementing processes are provided via the infrastructure [combination of the defense and commercially available communications and data processing infrastructures] on an as required basis. The collection of uncoupled users and sources of information supported by the infrastructure comprise the equivalent of a massive distributed database network facilitating enterprise-wide process improvements of high data intensity.

> *The IDE concept is driven by the pragmatic necessity to establish an information framework that will enable advanced business practices in the Defense Enterprise. Integrated Product and Process Development, Virtual Enterprises, Concurrent Engineering, Agile Manufacturing, Lean Logistics, Total Asset Visibility, et al., are all information intensive business practices that are not efficiently*

*supported by today's AIS-centric [automated information system] information environment. The IDE is designed to introduce a new information environment founded upon the principle of wide ranging, cross-functional access to self-identifying product information.*[15]

The goal of the IDE, as shown in Figure 2-4, may be best summarized as an integrated digital environment linking all stakeholders in the life cycle of a weapons system. Thus, allowing cross functional sharing of data that is created once and used throughout the entire life cycle of the system.

**CALS/IDE Initiatives**

As part of the CALS strategy the DoD is pursuing three infrastructure modernization programs with the goal of enabling the IDE.[16] They are Joint Computer-aided Acquisition and Logistics Support (JCALS), Joint Engineering Data Management Information Control System (JEDMICS) and Configuration Management Information System (CMIS). These three systems are being developed independently to work together in support of the DoD-wide IDE. The Army's Combat Mobility Systems (CMS) was the first program office to integrate these systems. This effort started in mid-1995 and was still underway in mid-1996. The CALS

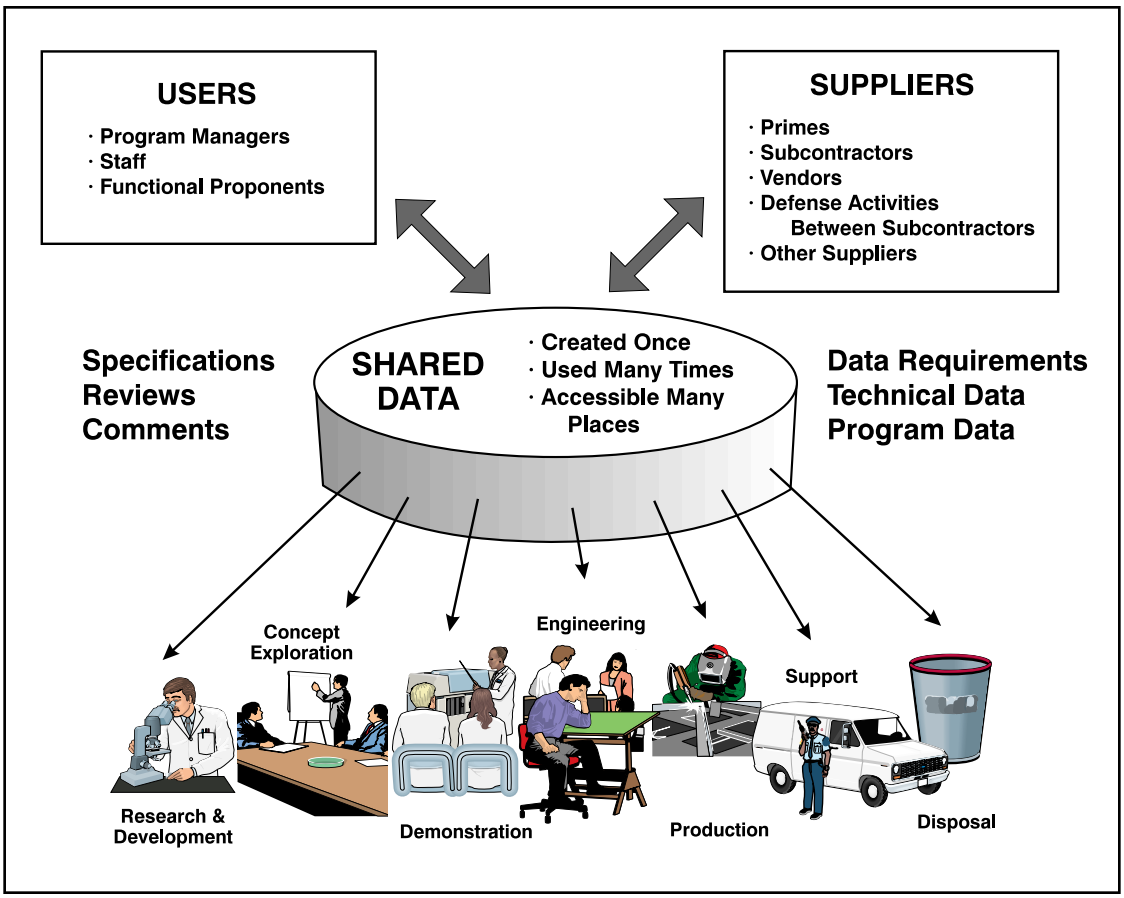


Figure 2-4. CALS Vision—Improve Product Life Cycle Information Management

Office has identified JCALS and JEDMICS as two of its "flagship programs."[17]

- **JCALS - The Joint Computer-aided Acquisition and Logistics Support**
  The JCALS program, an Army led initiative, is a key part of the CALS strategy. This program is intended to provide an Information Management System (IMS) to support uniform logistics, acquisition, engineering, management, and other life cycle functional processes. JCALS provides an infrastructure that supports a common and integrated organization and exchange of weapon system data throughout the entire life cycle. The system provides applications and services to implement cross functional processes. The goal of the JCALS program is to support more effective generation, exchange, management, and use of digital data. This enables the migration from manual, paper-intensive defense system operations to integrated, highly automated acquisition and support processes.[18]

- **JEDMICS - The Joint Engineering Data Management Information Control System**
  JEDMICS is a Navy led DoD program initiative for the management of approved engineering drawings and related technical data. The purpose of JEDMICS is to replace or supplement existing equipment at drawing repositories and technical libraries with an automated, state-of-the-art digital management system, thereby establishing a standard system for managing engineering and technical data in the Army, Navy, Air Force, and Defense Logistics Agency (DLA).[19]

- **CMIS - Configuration Management Information System**
  CMIS is being developed by the Joint Logistics Service Center (JLSC), which reports to DUSD(L). A DoD program software application, CMIS is designed to support configuration identification, change control, reporting, audits, and status accounting for weapon system programs. CMIS supports the life cycle baseline documentation and management of engineering designs and hardware. It tracks multiple baselines, establishes a functional baseline based on Hierarchical Structure Code by class, and tracks documents and part number information. Engineering documents, part numbers, and technical manuals/technical orders are cross referenced and accessed by the user from a single workstation.[20]

**Electronic Commerce (EC)**

The term EC is widely used by both the U.S. Government and industry. In industry the term EC is frequently used as the "umbrella term" to describe any digital exchange of information or data. Similarly, within DoD, EC is defined as the "paperless exchange of business information using Electronic Data Interchange (EDI), Electronic Mail (E-Mail), computer bulletin boards, FAX, Electronic Funds Transfer (EFT), and other similar technologies."[21]

**Electronic Data Interchange (EDI)**

EDI is the computer-to-computer exchange of business information using a public standard. EDI is a central part of EC because it enables organizations to exchange business information electronically and much faster, cheaper, and more accurately than is possible using a paper based system.

Who uses EDI? Currently about 50,000 private sector companies in the United States use EDI, such as Federal Express, Eastman Kodak, American Airlines, Nike, Staples, Nations-

Bank, JC Penney, and Prudential Insurance. EDI is widely used in manufacturing, shipping, warehousing, utilities, pharmaceuticals, construction, petroleum, metals, food processing, banking, insurance, retailing, government, health care, and textiles among other industries. According to a recent study, the number of companies using EDI is projected to quadruple within the next six years. The Government did not invent EC/EDI; it is merely taking advantage of an established technology that has been widely used in the private sector for the last few decades. ANSI X12 standards were developed to support EDI transactions for a wide variety of industry information applications.[22] (See Appendix C for a listing of ANSI X12 Version 3050 transaction sets.) ANSI X12 transaction sets are U.S. standards, although in the future ANSI X12 is expected to gradually align with an international set of EDI standards sponsored by the United Nations known as Electronic Data Interchange for Administration, Commerce, and Transportation (EDIFACT). Refer to Appendix B.

**Federal Acquisition Computer Network (FACNET)**

The FASA established the FACNET requiring the government to evolve its acquisition process from one driven by paperwork to an expedited process based on EDI. See Figure 2-5 for the FACNET process. The electronic system is intended to provide a *single face* to industry. FASA establishes parameters for FACNET both for Government and private users. These functions are to be implemented by agencies within 5 years of enactment of the Act. The Government-wide FACNET will be designed to:

- Inform the public about Federal contracting opportunities;
- Outline the details of government solicitations;
- Permit electronic submission of bids and proposals;
- Facilitate responses to questions about solicitations;
- Enhance the quality of data available about the acquisition process; and
- Be accessible to anyone with access to a personal computer and a modem.

Very simply, FASA raises the small purchase threshold to $100,000 and designates this as the *simplified acquisition threshold.* Procurement activities can use these new procedures when their activity is FACNET-certified.[23] Although FACNET is currently in use by over 200 DoD organizations and installations, there are other potential options. With the advent of the World Wide Web (WWW) some government activities, most notably NASA and DLA, have chosen to employ what they consider more open solutions than that presented by the FACNET.

**Contractor Integrated Technical Information Service (CITIS)**

CITIS is a contractor-developed and maintained service to provide electronic access and/or delivery of government-procured contractually required information (i.e., contract data requirements list (CDRL)). CITIS generally employs electronic networks for access and delivery of information and may include vendor and supplier data. It should be noted that CITIS is not the data itself or the database where it resides; CITIS is simply the service or mechanism that provides access to the data by authorized users. CITIS can be the back-

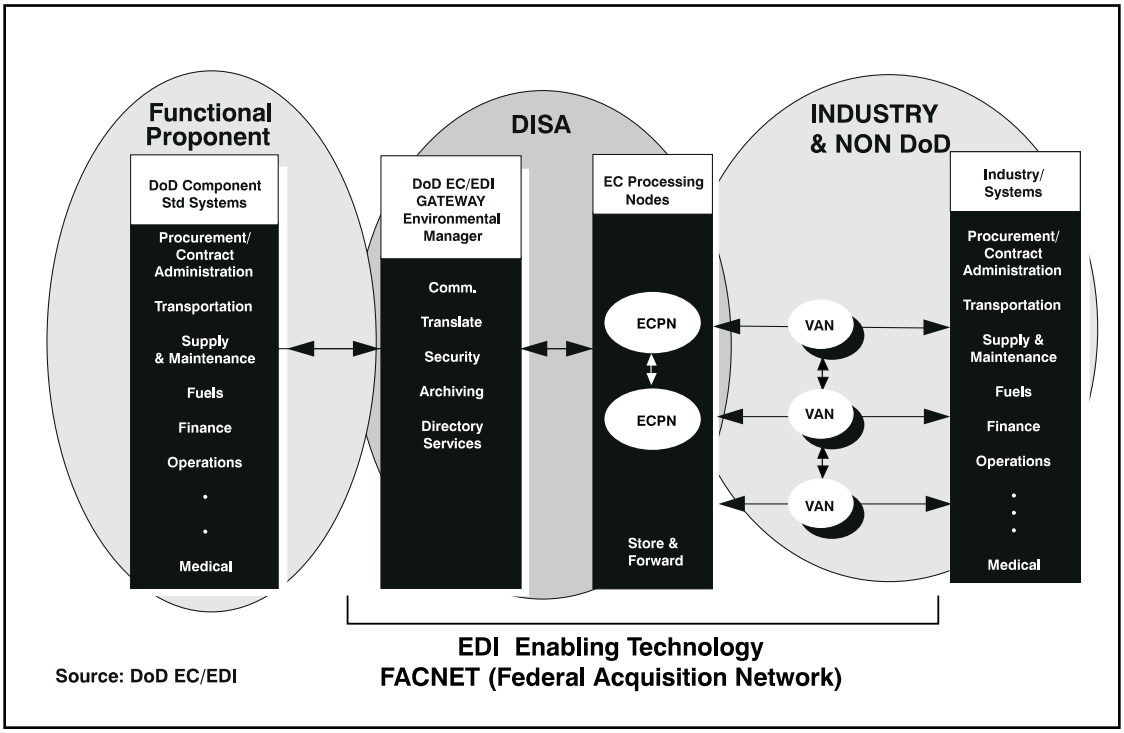


Figure 2-5. FACNET Architecture

bone of a PMO's integrated data environment, providing significant benefits to the PMO. It provides a single entry point for authorized government access to contractor-generated CDRL data and supports the philosophy of creating data once and using it many times. CITIS establishes a set of core information functions to facilitate the concept of "shared data," and standardizes functional characteristics of the data to facilitate usage by a wide variety of different users.

The primary advantages of using CITIS provide PMOs:

- Substantial reductions in the amount of data delivered and stored in paper format;
- Improved accuracy and timeliness of data;
- Improved management and tracking of review status;
- Reduction in review cycle time;
- Improved comment collection and correlation;
- Consistency of data used by all agencies/ activities;
- Readily accessible archive/repository of program data; and
- Opportunities to share data within the contractor's own enterprise, between the contractor and the Government, and between the Government's activities and locations.

The ultimate goal of CITIS is to reduce lead times and costs for weapons system design, manufacturing, and support processes, and at the same time assure technical information accuracy and timeliness. Figure 2-6[24] compares typical business practices with a program operation employing a CITIS.

CITIS supports the objectives of DoD 5000.2-R, paragraph 3.3.4.5, dated March 15, 1996: "Beginning in FY97, all new contracts shall require on-line access to, or delivery of, their programmatic and technical data in digital form, unless analysis shows that life cycle time or life cycle costs would be increased by doing so. Preference shall be given to on-line access to contractor developed data through contractor information services rather than data delivery. No ongoing contract, including negotiated or priced options, shall be renegotiated solely to require the use of digital data, unless analysis shows that life cycle costs would be reduced."[25]

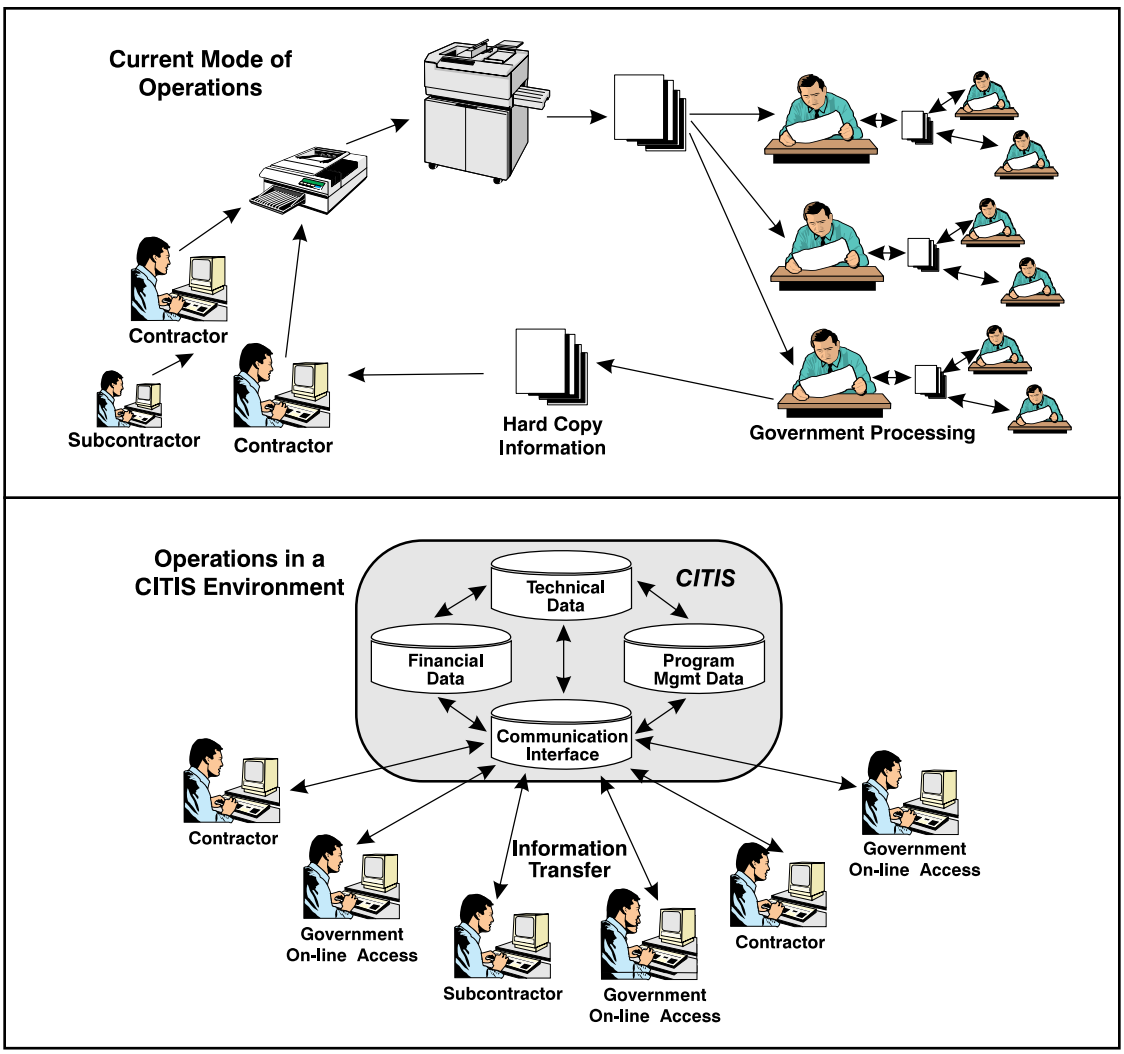


Figure 2-6. Current Operating Environment vs CITIS Environment

**Workflow Manager**

A workflow manager is a software application designed to increase productivity. Using customized rules or knowledge based processing, workflow managers enhance operations by automatically managing:

- Single point of administration and maintenance;
- Assignment of tasks (personal and group);
- Automatic initiation of actions;
- Coordination, timing, and sequencing of events;
- Notification, suspenses, and e-mail based reminders;
- Work in progress reports (project and process status);
- Continuous quality control (data integrity); and
- Data rights and access.

A workflow manager can be a key functional component of an integrated digital environment, helping organizations achieve greater efficiency through near real time collaboration despite geographic and functional separation. By its design, workflow managers go beyond e-mail by permitting greater flexibility through parallel processing, quicker access to the right data by the right people at the right time, and providing a coordinated and integrated decision making environment. See Figure 2-7.

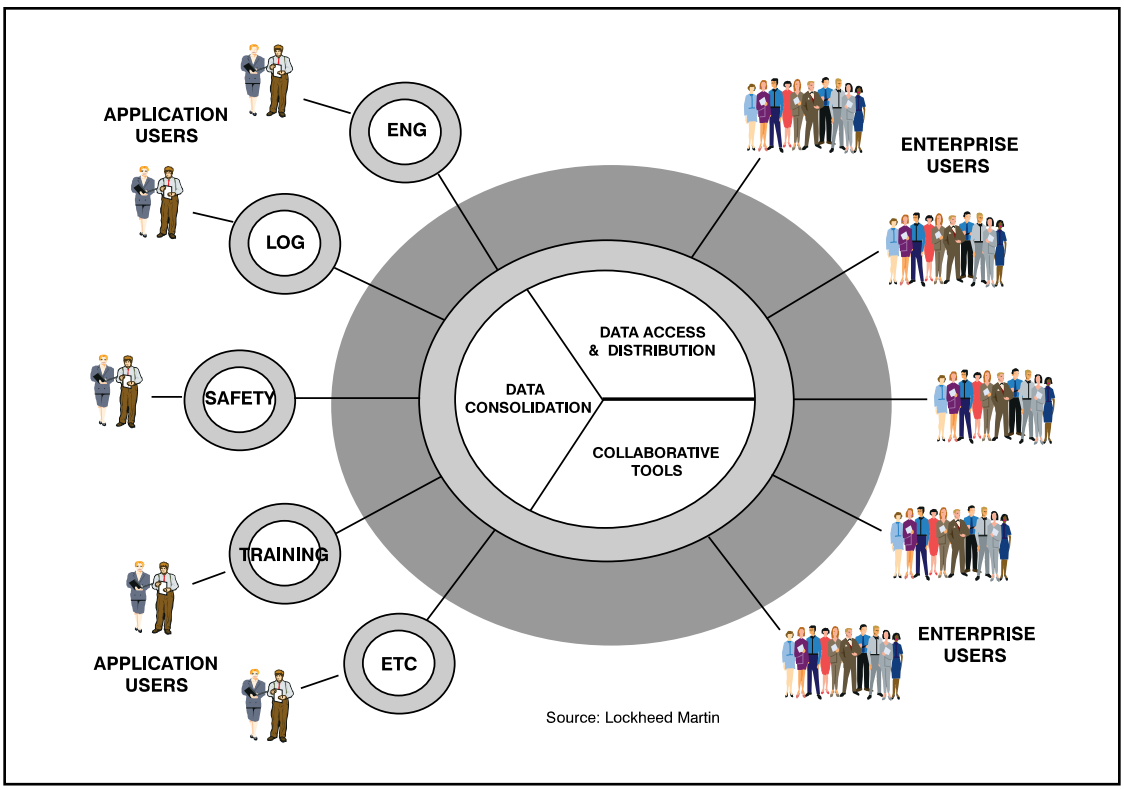


Figure 2-7. Collaborative Work Environment

**Acquisition Program's Digital Environment (APDE)**

In this research report, the researchers develop the concept of an APDE, see Figure 2-8. Defined as a cross functional integrated digital environment linking the entire acquisition program team, the APDE is a realizable, program specific subset of the DoD-wide IDE vision. The primary difference between the two is that an APDE focuses on an individual acquisition program, and its development is within the span of control of the PM. APDE supports program specific requirements and enables process improvements, increases in efficiency, and reengineering efforts that are achievable by both the PMO and Government-industry acquisition partners.

An APDE can range in complexity from the very simple to the very complex. At the low end, key people may share e-mail and limited information sets within the PMO and/or with the prime contractor, perhaps incorporating commercial software to facilitate data access. At the high end, an extensive digital infrastructure enables every active participant to have direct access to all pertinent data relating to one's function or process, regardless of the physical location of the database. These active participants include not only the PMO and prime contractor personnel, but also sub-contractors, vendors, suppliers, support agencies, and end users. Figure 2-8 depicts elements that comprise an APDE. What is right for your particular PMO is a point somewhere along this continuum. As with the IDE, the use of standards to support data exchange and interoperability are essential to an APDE.

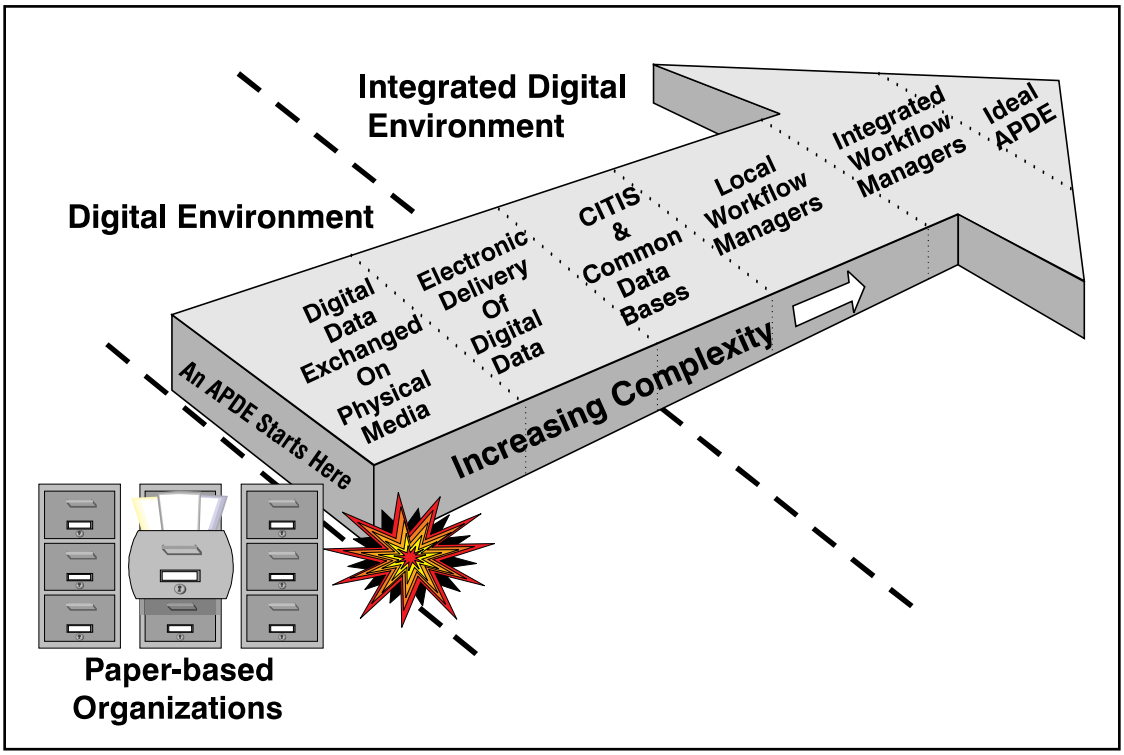


Figure 2-8. APDE Model

The APDE model is not meant to imply a required order of implementation. Lower level elements, such as CITIS, are not necessarily prerequisites of higher level elements. As the degree of complexity moves from simple digital delivery of data to shared data access, the APDE moves into an integrated digital environment. The APDE recognizes that the digital infrastructure will be an evolving set of digital environments that mature as a program transitions from concept exploration through design, production, fielding and finally disposal. This environment will have different characteristics over time in terms of infrastructure, users, processes, and access requirements. During early design phases the environment is characterized as highly dynamic, design trades are underway, and users are few with involvement in computationally intensive activities. This is in contrast to the post production portion of the life cycle when the design is largely fixed but there are a large number of users who need access to mature program information. In Figure 2-9 all the stakeholders would be linked to each of the environments; however, the principal users change as a function of the program life cycle. *It must be emphasized that throughout the life cycle all players must be involved; it is only the focus and the dynamic nature of the environment that changes*.

**Summary**

Moving into the information age and exploiting the potential of integrated digital environments is key to the future success of the acquisition community. However, as it necessitates crossing functional, organizational, and process

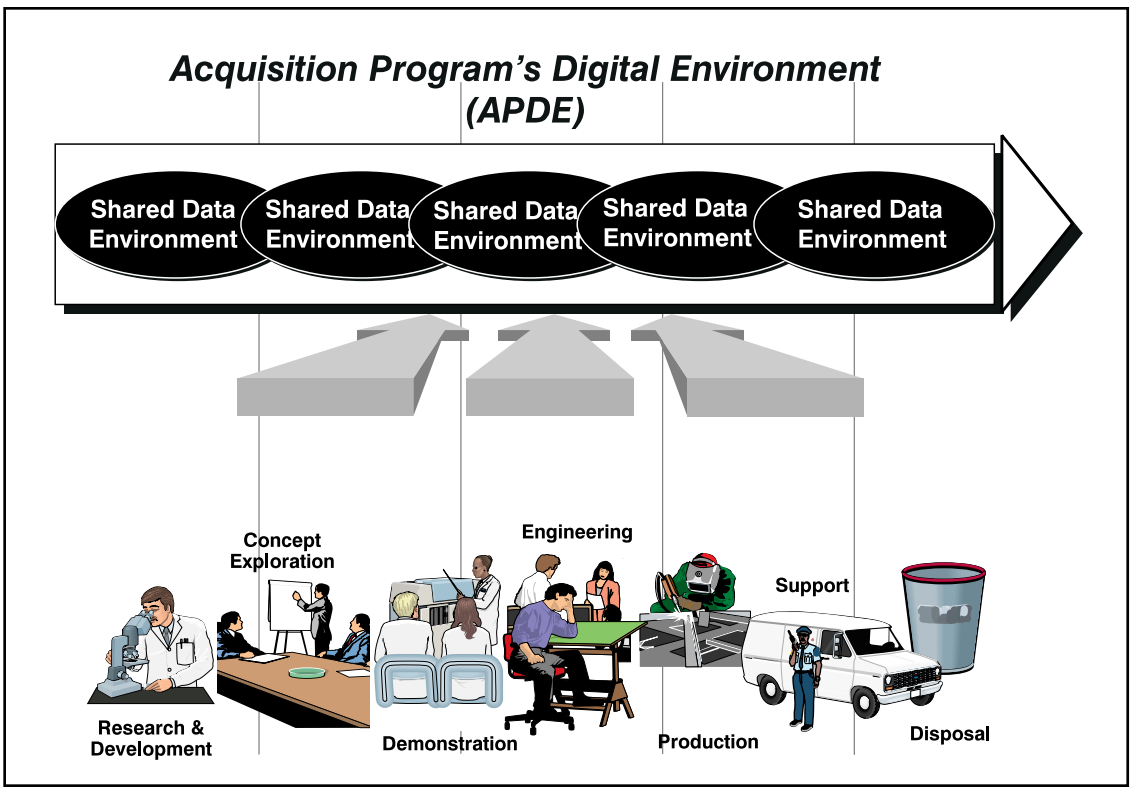


Figure 2-9. APDE Evolutionary Process

boundaries, it has far reaching implications that impact DoD, the U.S. Government, industry, and even the international community. The Defense Acquisition Community must at least be aware of these factors and attempt to take advantage of opportunities that they present. There are many organizations that play an active role, along with numerous ongoing and overlapping initiatives. In some cases, ongoing efforts are beyond the control of the PM. However, there is still much that can be done. For this reason, the APDE was developed. It provides a framework that recognizes the disparate nature of digital environment initiatives, yet enables the PMO and industry partners to capitalize on the advantages that such initiatives offer.

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